

COASTAL ENGINEERING WITH NATURE AT THE INTERFACE BETWEEN BEST AVAILABLE SCIENCE, ENGINEERING, MANAGEMENT, AND COMMUNITY NEED

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INTRODUCTION

As coastal communities are forced to cope with a changing climate and associated sea level rise, and coastal squeeze, there is an increased need for more adaptive coastal protection strategies. On the open coast, traditional static coastal protection strategies, such as sea walls and rock revetments, are being questioned by regulators, coastal planners, and coastal citizens alike. Instead, increasing value is being placed on dynamic natural and nature-based strategies for coastal protection. Natural and nature-based strategies, including coastal foredunes and/or cobble berms seaward of dunes or bluffs, are an alternative to traditional strategies and offer a first line of defense against the impact of coastal storms and inundation while potentially providing more co-benefits than traditional structures. However, the design and implementation of natural and nature-based features typically requires more collaboration between a range of interdisciplinary stakeholders (Palinkas et al., 2022).

On the U.S. Pacific Northwest (PNW) outer coast, there are both naturally occurring dune backed beaches and cliff backed cobble beaches that have inspired nature-based engineering strategies for erosion control (i.e., sandy and vegetated dunes and dynamic revetments). Coastal communities want to mitigate and/or manage sand movement now, so policy and regulatory-based agencies are seeking the best available knowledge regarding the ecosystem services and dynamics associated with coastal foredune and cobble berms. Management needs and gaps in scientific knowledge and engineering practice often go hand in hand. Therefore we are working to develop guidance documents that combine management needs with the best available engineering and scientific knowledge to

identify, synthesize, and address community-driven priorities for coastal dunes and dynamic cobble revetments in the PNW.

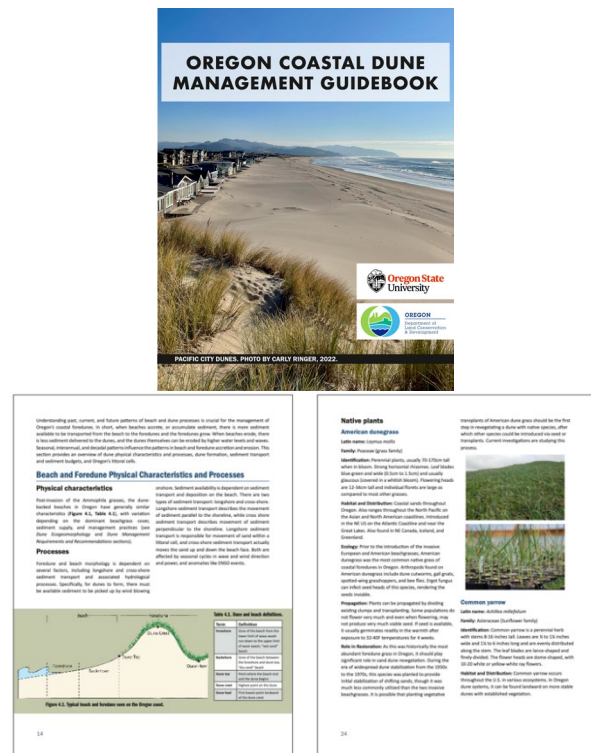


Figure 1 – Cover and example pages from the Oregon Coastal Dune Management Guidebook

METHODS

Outside of traditional literature review, our group has used an integrative approach of management-focused mini-conferences and workshops, targeted surveys, and key stakeholder conversations to identify existing management needs and scientific and engineering

knowledge gaps for coastal dunes in Oregon and dynamic revetments in Washington and Oregon. We have used these results to co-produce management guidance documents and state of the practice reports that are accessible resources for state and federal agencies, community planners, community members, and engineers to use while planning or implementing nature-based designs or management actions. We have also used this process to identify scientific and/or engineering knowledge gaps to rigorously test through field and laboratory observation and manipulative experimentation. Throughout the process, we engage our key stakeholder networks to ensure that project progress and goals remain in alignment with stakeholder needs and expectations.

RESULTS

To date, we have four key products from our work, which have cultivated a highly engaged stakeholder network that identifies key management needs and scientific/engineering gaps for both dune management and dynamic revetment implementation in the PNW.

- The first product is a report from the Oregon Coastal Dunes Management Workshop and Mini-Conference. The workshop and mini conference engaged approximately 70 stakeholders and scientists from Oregon, Washington, and California and cultivated four priority areas for management and scientific advancement pertaining to Oregon coastal dunes (Mcnamee, 2022).
- The second product of our work is the *Oregon Coastal Dunes Management Guidebook* (Figure 1), which shares the best available science for Oregon coastal dune geomorphology, native and invasive plant species, and how management choices influence geomorphology and habitat in coastal dunes. Prior to this guidebook, knowledge was reported in various published and unpublished venues, and is now compiled in a single guidance document.
- The third product is the Guidebook on Erosion Control Practices for the Oregon Coast (DLCD 2021). The aim of the guidebook is to provide a centralized resource for information about the design and permitting of erosion control methods on the Oregon Coast to a non-technical audience. The guidebook defines the difference between structural erosion control and nonstructural erosion control. The guidebook synthesizes information about a range of structural and non-structural erosion control techniques that are viable for the Oregon coast by using case studies, reports, and academic literature.

- Finally, we have produced a State of the Practice paper for dynamic cobble revetments in the PNW. In this paper, we review the design goals and procedures of five dynamic cobble revetments in the PNW to assess and document current design tools and practices. We also report on a survey that identifies knowledge gaps, engineering needs, and stakeholder values in dynamic revetment design.

Each co-produced product synthesizes the present state of knowledge into best available guidance for the design and management of natural and engineered coastal features. Each document also highlights shortcomings in knowledge and creates a basis for further stakeholder-engaged research studies.

CONCLUSIONS

Stakeholder engaged research is critical in the design and implementation in natural and nature-based coastal protection strategies. It takes effort to consider and incorporate many different perspectives and capture them in accessible management guidance documents and state of the practice reports. Our approach incorporates published research, practitioner experience and input, and community goals to provide stakeholders with relevant and usable products. Our products are not a substitute for traditional journal publications; instead, they are intended to be more accessible and used by a broader audience than the traditional journal publication might target. Additionally, we have found that our approach has helped to identify important future research directions that will contribute to the coastal community competence for leveraging nature in coastal engineering design.

REFERENCES

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